High performance organic nonvolatile memory device

Yang Yang

Department of Materials Science and Engineering, University of California at Los Angeles, Los Angeles, California 90095

We present a novel high performance organic nonvolatile memory device, the organic bistable device.[1-3] This organic bistable device (OBD), with a unique trilayer structure consisting of organic/metal/organic sandwiched between two outmost metal electrodes, shows interesting electrical bostable states. Typical I–V curves are shown in Fig. 1. During the first bias scan, the device shows a very low current in the low-voltage range (0–3 Volts), indicating the device is at a high impedance state. However, at a critical voltage, ~3 V in Fig. 1, the current has a sharp increase of several orders of magnitude, indicating the device has had a transition from the high-impedance state to a low-impedance state. However, the I–V curve recorded in the second bias scan is totally different from that observed in the first bias scan. Even in the low-voltage range, the device shows very high current, indicating that the device remains in the low-impedance state. When the device is switched to the low-impedance state, it remains in that state even when the power is off. The high-impedance state can be recovered by applying a reverse bias, suggesting this kind of device is ideal for memory applications. The switching time for the OBD is in the nanoseconds time scale (Fig. 2). The switching time of 10 ns originates from the RC time constant of the measurement system. The features of OBD make it ideal for applications, such as low-cost, large-area, flexible, high-density, electrically addressable data storage devices.

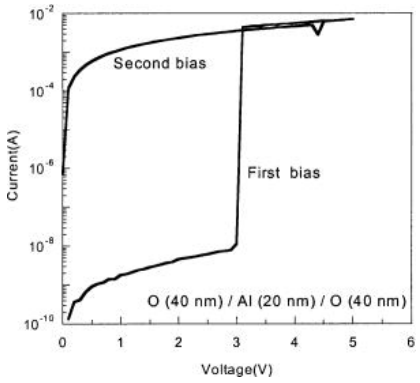

Fig. 1 I–V characteristics of an OBD recorded

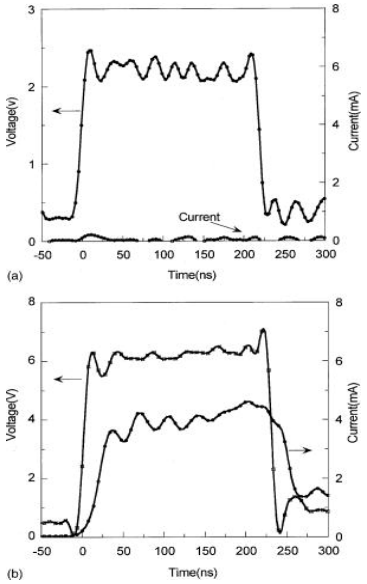

Fig. 2. The transient behavior of an OBD below and above the threshold voltage. (a) a voltage pulse less than the switch-on voltage is applied to OBD; (b) the electrical current response of the OBD under a voltage pulse higher than the switch-on voltage.

1. Liping Ma, Jie Liu, Seungmoon Pyo, Qianfei Xu, Yang Yang, "Organic bistable devices", Molecular Crystals and Liquid Crystals, 378, 185-192, (**2002)**.

2. Liping Ma, Jie Liu, Seungmoon Pyo and Yang Yang, "Organic bistable light-emitting devices", Appl. Phys. Lett., .80, 362, (**2002**).

3. Liping Ma, Jie Liu and Yang Yang, "Organic electrical bistable devices and rewritable memory cells", Appl. Phys. Lett. 80, 2997, (**2002**).